

DESCRIPTION

The Model 2303 Serial <-> Digital Interface Board provides 40 programmable bi-directional data lines for controlling devices, for transferring digital data or for monitoring digital signals. The 2303's serial interface provides all of the functionality of a GPIB interface but allows for control of the digital signals over an RS-232 link or over an RS-485 network. A user settable address lets multiple 2303s be operated on a RS-485 network with other RS-485 devices. The 2303 is interchangeable with ICS's other xx03 boards and can use all of their existing accessories including the xx03DVR Relay Driver Board.

In a typical application, the 2303 is located inside the host device and is powered by the device's +5 volt power supply. Signal connections can be made with flat ribbon cables that plug-in to the serial and digital headers on the 2303. Serial settings can be changed with SCPI commands or by a switch that plugs into the 2303. Either way, the 2303 is a quick and easy way to add an RS-232 or network ready RS-485 interface to most digital devices.

The 2303 includes a complete manual and a configuration disk with sample programs. ICS's SERkybd program lets the user easily send the 2303 standard serial messages, addressed messages for network operation or packets for ICS's packet protocol.

Versatile Digital Interface

The 2303's digital interface is configured with commands from the Serial Interface. The

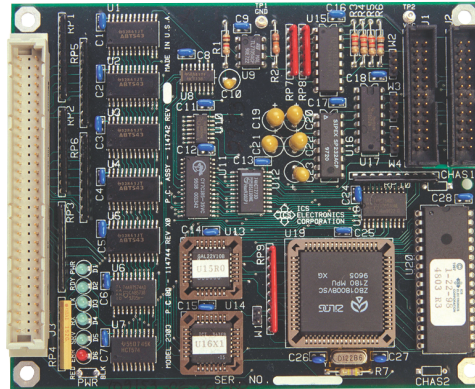


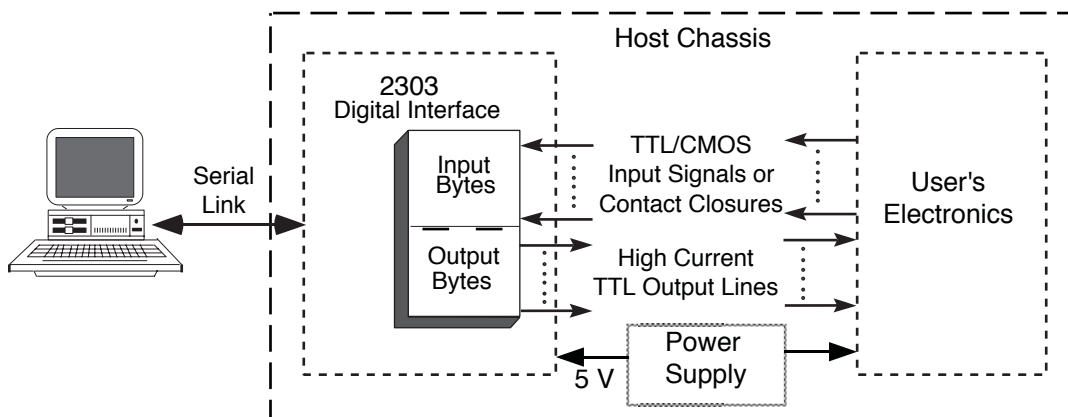
Figure 1 2303 Serial to Digital Board

configuration commands permit the user to designate the data lines as inputs or outputs in 8-bit byte increments, to connect the bytes into strings, to set data polarity, data format, handshake modes and data format. When done, the setup configuration is saved in the 2303's flash memory and becomes the new power-on configuration. The 2303 provides a Stable output signal that goes true after the Digital I/O lines have been configured that can be used to avoid glitching sensitive devices like relays.

Data Transfer Methods

Data transfer between the serial interface and the 2303's digital interface can be directly to or from specific bytes, as bit commands, or as strings of values to or from one or more bytes. The user can mix methods as he assigns the input and output bytes.

- Provides a user-definable, 40-line parallel interface with bit, byte, pulse and string data transfer capabilities. *Fully configurable to the user's needs by bus commands.*
- Pull up resistors on all inputs for switches and CMOS signals. *Handles TTL/CMOS signals and contact closures.*
- Monitors up to 15 input lines for level changes. *Automatic event and status change detection*
- Fast RS-232/RS-485 interface operates up to 115.2 Kbaud. *Also supports network protocol.*
- IEEE-488.2 Compliant with SCPI Commands. *GPIB functionality over a serial link.*
- Interchangeable with ICS's 4803 GPIB and 8003 Ethernet Interfaces. *Convert from Serial to GPIB or Ethernet (LAN) interfaces replacing a card.*
- Support includes a menu driven configuration program and SERkybd program. *Easy configuration and serial command generation.*



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Controlling the Digital Interface

Figure 2 shows the different ways the 2303 can be used to transfer data. The arrows show the data direction. Figure 2 is an example only and the bytes can be assigned in any order to fit the application.

The bit and byte commands automatically set the data direction for their respective data bytes when the command is first executed. Bit command examples are Close, Open and Read which operate on bytes 1 and 2. New pulse commands let the user pulse individual or multiple lines. A single pulse width setting is used when pulsing any or all lines.

Byte commands write or read all 8 bits in a byte. Figure 2 shows the BO3 command writing all 8 bits to byte 3 and the BI4? query reading all bits from byte 4. Data strobes can be manually generated if needed. The user can set the data polarity on a bit or byte basis for all of the bytes controlled by the bit and byte commands.

String commands transfer one or multiple bytes of data at a time. String commands only work on data bytes that are pre-configured as input or output bytes by the CONFigure commands. The user can configure 1 to n bytes as inputs and/or as outputs to make data words up to 40-bits wide. Figure 2 shows two bytes (bytes 5 and 6) configured as outputs and their values are set by the four hex digits in the PO command. A data strobe is automatically generated when data is outputted by a string command. When outputting data strings, the 2303 converts the string of characters into packed HEX bytes, places the data in the configured output latches and generates a data strobe pulse to update the external device. The data strings can be a series of decimal values, ASCII HEX characters, or the 30-3F HEX characters used in ICS's older interfaces.

The PI? query reads 16 bits of data from bytes 7 and 8. Data can be inputted with or without handshaking. The parallel input data can be formatted as decimal numbers, as ASCII HEX characters, or into any user selected character set.

The configuration and output data values can be saved at any time. The saved configuration and output values become the new power turn-on default values and are restored when the unit is reset or when power is turned on. This allows a user to set the output signal states for power turn-on time.

Input Signal Monitoring

The 2303 can monitor up to fifteen of the digital inputs for signal changes and generate a Service Request Message (SRM) to notify the computer when changes occur. Monitoring is done by setting the 2303's Questionable Transition register to detect positive and/or negative signal transitions and enabling bits in the Questionable Event Register. When the enabled bit(s) are detected, the 2303 generates an SRM to alert the computer to the event. The user queries the 2303's Questionable Condition Register to determine the input signal states and the Event Register to learn which signal changed state. Application Bulletin 48-18 describes how to configure the 2303's Status Reporting Structure registers and includes a program example.

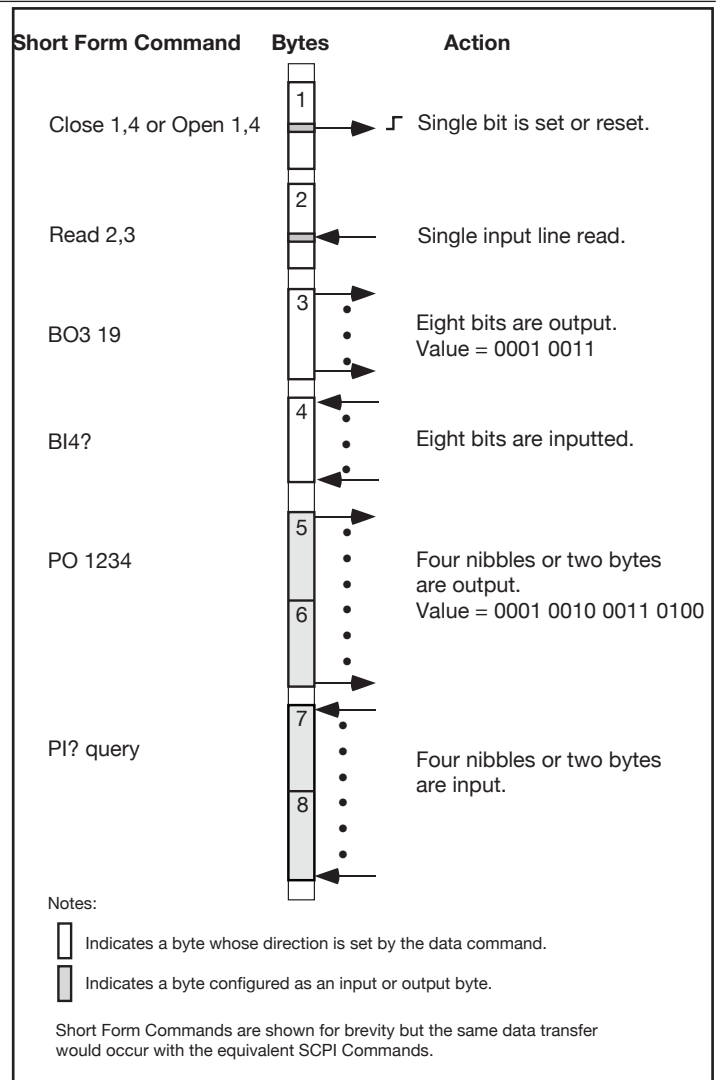


Figure 2 2303 Digital Data Transfer Methods

(Figure 2 shows 8 bytes for illustrative purposes even though the 2303 only has 5 bytes)

Configuring the 2303

The 2303 uses SCPI commands to configure the Digital Interface to transfer data. Most SCPI commands have a corresponding Short Form command for quick programming. Most of the functions can also be queried to verify the command setting. (i.e. BO1? reads back the last value outputted to byte 1)

The SYSTem branch sets the unit's serial settings which includes character format, baud rate, network address and addressing mode. OFF is the standard asynchronous communication method. RS485 selects full or half duplex operation for the RS-422 transmitter.

The CONFigure branch assigns the bytes for string data transfer and sets their data polarity and handshaking. The CONFigure branch commands are not used to assign bytes used by the bit or byte commands. These commands have their own direction and polarity controls and are not configured with the CONFigure commands. The CONFigure branch also sets the control signal polarities.

2303 SCPI COMMAND TREE

SCPI Commands	Short Form Cmds	
SYSTem	Serial Settings	
:COMM		
:SERial		
:EXternal	0 1	
:BAUD	<numeric>	
:PARity	EVEN ODD [NONE]	
:BITS	7 [8]	
:SBITS	[1] 2	
:NETwork	[OFF] ADDRess PACKet	
:ADDRess	0-15 [4]	
:UPdate		
:RS485	[0] 1	
:ERRor?		
:VERSion?	(1994.0)	
CONFigure	Configure I/O	
[:DIGital]		
:INPut	<channel list>	N
:POLarity	0 1	TPn
:HANDshake	<boolean>	TBn
:OUTput	<channel list>	LN
:POLarity	0 1	LPn
:HANDshake	<boolean>	LH
:CLEar	0 1 C	
:EDR	0 1	E
:INHibit	0 1	I
:REMote	0 1 R	
:RESet	0 1	X
:STRobe	0 1	S
:TRIGger	0 1	TR
:ASTATus	0 1	A
:BSTATus	0 1	B
FORmat		
:TALK	<ASCIi Hex HEXL Table>	
:TRANSlation	<16 char string>	V
:LISTen	<ASCIi Hex HEXL BIN 4833>	
ROUTE	Bit Commands	
:CLOSE	byte, bit	CLOSE
:OPEN	byte, bit	OPEN
:RESEt	byte	BRESEt
:PULSe	byte, bit	PL
:CHANnel	number or channel list	PC
:WIDTh	10-30000 [50]	PW
SENSe	Input Data	
[:DIGital]		
:DATA		
:VALue?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BIn?
:POLarity?	Pn	
:RESet:EDR		ER
:BIT?	0-1	READ?
:BYTe?	0-255	BREAD?
[SOURce]	Output Data	
[:DIGital]		
:DATA		
:VALue	0-255	PO
:PORTn	0-255	BOn
:POLarity	0-255	OPn
:STRobe		SP
CALibrate	Calibrate Configuration	
:IDN	string (72 char max)	
:DATE	mm/dd/yy	
:DEFault		
:LOCK	1(On) 0(Off) [0]	

The FORMat branch sets the data formats for the string commands and the characters used in the user's Talk conversion table.

The ROUTe branch lets the user set or reset individual bits in an output byte. Data polarity is set by the SOURce branch.

The SENSe branch gives the user a way to read digital data from a single byte, from bits or from the configured input bytes. When reading data from a specific byte, input data polarity can be assigned on a bit-by-bit basis.

The SOURce branch provides a way to write values to a byte or to the configured output bytes. When data is outputted to a specific byte, output data polarity can be assigned on a bit-by-bit basis.

The STATus branch is used to setup and query the Operational and Questionable Registers so that changes in the digital inputs or status inputs can be used to generate 488 Service Requests. The Questionable Registers can be used to monitor and query the first 15 digital I/O lines. The Operational registers can be used to examine or monitor the two external Status inputs.

The CALibrate Commands let the user personalize the 2303 with his own IDN string, lock settings to prevent changes and to reset the unit to the factory settings.

GPIB Functionality

The 2303 provides GPIB functionality over a serial link. The 2303 is functionally and physically equivalent to ICS's 4803 GPIB <->Digital Interface and 8003 Ethernet<->Digital Interface Boards. Signal pinouts are the same on all three boards. The only difference is the command interface.

The 2303 executes all of the 4803 commands for a single GPIB address mode. This means that a user can switch from a Serial to a GPIB or LAN interface for his product by simply plugging in a different interface card.

Because the 2303 has a serial interface, it really cannot assert the GPIB SRQ line to request service. Instead, the 2303 transmits an asynchronous Service Request Message (SRM) to alert the application that it needs service. SRM generation is controlled in the same manner that SRQs generation is handled in any IEEE-488.2 instrument.

OEM Configuration Features

The user can change the board's IDN message to personalize the 2303 as part of the end product. The IDN message, the 2303's parallel interface configuration and serial settings are saved in nonvolatile Flash memory. A lock command protects the configuration settings from being accidentally changed by the end user.

Signal Connections

The 2303 has three ribbon connectors: two for serial signals and one for the parallel interface. The first serial connector is for direct pin-pin connection with a flat-ribbon cable to a DB-25 type serial connector. The second serial connector provides the baud rate and format setting switch inputs along with the serial signals on one header.

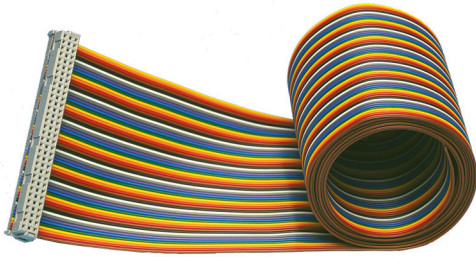


Figure 4 112343 Open-end digital flat-ribbon cable

The parallel interface connector is a 3-row, 64-pin DIN connector with the 40 parallel data lines, handshaking and status signals. Mating connectors and an open-end flat-ribbon cable, shown in Figure 4, are available to assist the user with his signal wiring. See the Ordering Guide on page 5 for a complete list of accessory items.

Mounting Methods

Standard 2303 boards have the connectors facing up on the component side and can be mounted against a panel or on the chassis floor. Access the digital I/O signals with a flat-ribbon cable or by wiring to the mating solder eyelet connector.

2303 boards are also available with a male DIN connector mounted on the circuit side so the 2303 can be piggybacked on a larger PCB assembly as shown in Figure 5. This is a good mounting method when the design is such that a PC board is needed for mounting other devices since it eliminates a cable and wiring. Use a 902257 or a 902058 DIN connector with male pins on the PC board.

Relay Driver Board

The 4803DVR Board expands the 2303's TTL outputs by providing forty 300 mA relay drivers with convenient screw terminals. See Figure 6. A 2303 with J3 mounted on the circuit side piggybacks on the 4803DVR board to make a compact assembly. The 4803DVR board can be configured for all 40 lines to be relay driver outputs or for 8 or 16 lines to be 2303 TTL I/O lines. The 4803DVR Board is powered by the relay power supply and it supplies 5 Vdc power to the 2303.

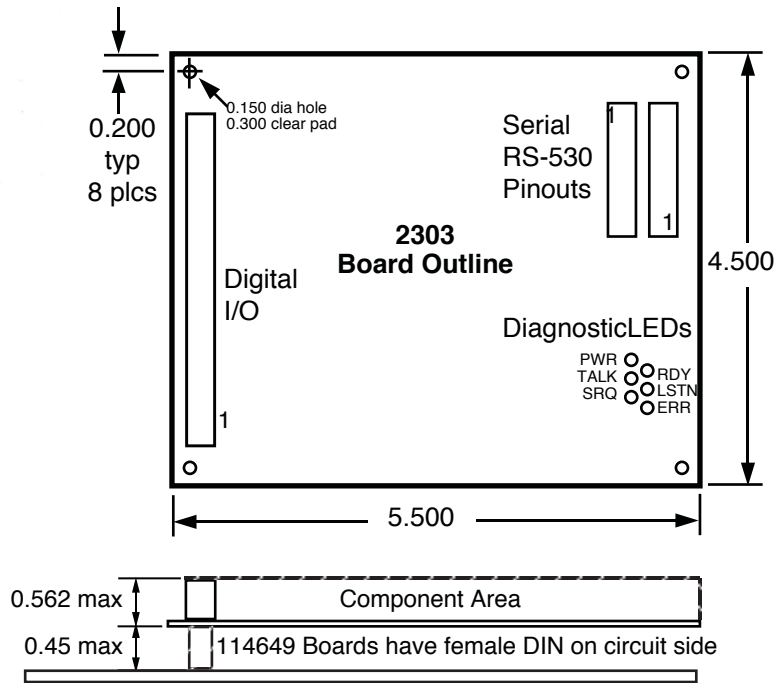


Figure 5 2303 Outline and Mounting Dimensions

Figure 6 4803 Relay Driver Board

Refer to the separate 4803DVR Board data sheet for complete specifications and mounting dimensions.

Extended Temperature Version

The Model 2303-ET is manufactured with extended temperature range components and is rated for operation over -40°C to $+85^{\circ}\text{C}$. The Model 2303-ET has the same performance as the Model 2303 and is shipped with the same accessories.

2303: ORDERING GUIDE

Select from one of the two 2303 board styles and then pick your accessory items.

Part Selection	Qty	Part Number									
Standard 2303 board with the digital IO connector on the component side	(1)	2303									
<div style="border-left: 1px solid black; padding-left: 10px;"> Select one mating digital IO connector - <table border="0" style="display: inline-table; vertical-align: top; margin-left: 20px;"> <tr> <td style="padding-right: 10px;">Solder eyelet</td> <td style="text-align: right;">(1)</td> <td style="text-align: right;">902023</td> </tr> <tr> <td style="padding-right: 10px;">Solder pins</td> <td style="text-align: right;">(1)</td> <td style="text-align: right;">902067</td> </tr> <tr> <td style="padding-right: 10px;">Flat-ribbon cable</td> <td style="text-align: right;">(1)</td> <td style="text-align: right;">902124</td> </tr> </table> </div>	Solder eyelet	(1)	902023	Solder pins	(1)	902067	Flat-ribbon cable	(1)	902124		
Solder eyelet	(1)	902023									
Solder pins	(1)	902067									
Flat-ribbon cable	(1)	902124									
or											
Select an Open end, flat ribbon cable assembly, 5 feet long	(1)	112343									
or											
Select the 4803 Relay Driver Board (Mounts on top of std 2303)	(1)	115522									
Select a Serial Flat ribbon Interface Cable, 10 to 90 cm long	(1)	114256-L									
2303 board with the digital IO connector on the circuit side (facing down) for mounting on another PC board	(1)	114732									
<div style="border-left: 1px solid black; padding-left: 10px;"> Select digital IO connector with solder pins for the mating PC board </div>	(1)	902257 or 902058									
or											
Select the 4803 Relay Driver Board (Holds the 114732, 114733 boards)	(1)	115490									
Select a Serial Flat ribbon Interface Cable, 10 to 90 cm long	(1)	114256-L									

Notes:

1. -L is the cable length in cm. You can order any length from 10 to 90 cm. Standard stocked lengths are: 30, 45, 60 and 90 cm. Select an appropriate length as it is best to not have extra cable coiled up in the chassis to minimize EMI pickup. See the GPIB Connector/Address Switch Assembly data sheet for more details.

Serial Interface

Provides RS-232 full duplex and RS-485 (RS-422) half duplex asynchronous serial interfaces. Unit automatically responds to the serial interface that receives the command.

RS-232 Interface

Signals: AB, BA and BB
Mode: Full Duplex

RS-485 (RS-422) Signals

Signals: TX/RX pair
Mode: Half duplex with or without network address detection
Addresses: 0 to 15
Termination: 220 ohm load resistor, 1 K Ω pullup/pull down resistors.

Data Rates and Formats

Baud Rate: 1200 to 115.2 Kbaud
Data bits: 7 or 8
Stop bits: 1 or 2
Parity: Odd, Even or None

Command Sets

SCPI and short form commands listed in Table 1 plus the following IEEE 488.2 Common Commands:
*CLS, *ESE, *ESE?, *ESR?, *IDN?, *OPC, *OPC?, *PSC, *PSC?, *RCL, *RST, *SAV, *SRE, *SRE?, *TRG, *TST, and *WAI.

Signal Characteristics

The 2303's parallel I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

Data	40 lines in 8 bit bytes
Status	2 general purpose inputs
Input Logic Levels	High = $> +2.4$ V Low = < 0.5 V @ -200μ A 33 Kohm pullup to +5 Vdc for normally open contacts. Max High = 5.5V
Input Timing	Two External Data Ready inputs with Inhibit outputs. Sets within 1 μ s of the active edge of the EDR Input signal and resets after data is loaded. Data loading time for 6 BCD/HEX characters is 4 ms (typ.)
Output	High = > 3 V with 3 mA source
Logic	High = > 2 V with 24 mA source
Levels	Low = 0.0 to +0.8 Vdc, 48 mA sink
Output Timing	Data is transferred to the output within 1.6 ms after receipt of a terminator; output data stabilizes 0.35 ms prior to the data transfer strobe. Pulse width 10 to 30000 ms
DataStb Trigger Reset	Output pulse width, 40 μ s Output pulse width, 40 μ s True during 2303 Reset time (1 ms)
Remote	Output level true when 2303 is in its remote state.

Diagnostic Indicators

Six on board LEDs. Lo true drive signals on parallel I/O connector for remote LEDs
PWR, RDY, TALK, LSTN, SRQ and ERR

Physical

Size, L x W x H
139.7 x 114.3 x 12.7 mm
(5.5 x 4.5 x 0.5 inches)

Connectors and Headers

Serial: 26-pin 3M 2526 male
Serial/Addr: 26-pin 3M 2526 male
Parallel: 96-pin, 3 row male DIN conn, rows A & C.

Temperature standard version

Operation -10° C to $+70^{\circ}$ C
Storage -20° C to $+85^{\circ}$ C

Temperature extended range version

Operation -40° C to $+85^{\circ}$ C
Storage -40° C to $+85^{\circ}$ C

Humidity

0-90% RH without condensation

Power +5 Vdc @ 400 mA (typical)

Included Accessories

Instruction Manual
Support CD-ROM with Configuration and sample programs

Available Accessories

See the Ordering Guide on page 5 for all optional items.

Serial flat ribbon cable 90 cm max.,
P/N 114256-90.

Open-end rainbow ribbon cable, 5 ft,
P/N 112343

Mating DIN Connectors:

P/N 902023 Solder Eyelet
P/N 902067 Dip Solder
P/N 902124 Flat ribbon Cable

ORDERING INFORMATION

	Part Number
Serial <-> Parallel Digital Interface Board (Includes Instruction Manual and Support CD)	2303
Serial <-> Parallel Digital Interface Board (Board only)	114742
Serial <-> Parallel Digital Interface Board- Extended Temperature Range (Includes Manual and Support CD)	2303-ET
Serial <-> Parallel Digital Interface Board- Extended Temperature Range (Board only)	114742-02
Serial flat-ribbon cable, 2303 to DB-25P male connector, length 90 cm max.	114256-90
Open-end Rainbow colored flat ribbon cable, 5 feet long	112343